Antarctic Regions. — The British Government has refused the request of the Australian colonies to grant a subsidy to the proposed Antarctic expedition which was to be organized by a joint effort of the Australian colonies in case the British Government should support the undertaking. This decision will probably postpone the resuming of Antarctic exploration for an indefinite time. Although it is not probable that results of great commercial value will be obtained by an expedition of this kind, the scientific objects are so great that this new delay must be greatly regretted.

ELECTRICAL SCIENCE.

Electricity directly from Heat.

Attempts to generate electric currents, by utilizing the fact that magnetic metals lose their magnetic properties when sufficiently heated, have been made for some years. It is only recently, however, that such experiments have been made on a practical scale, and with any promise of ultimate success. When we consider that in the most economical source of electricity, the dynamo-electric machine, we transform the energy of our fuel to the energy of steam under pressure, then through the steam-engine to mechanical work, and finally by the dynamo to the energy of electrical currents, losing energy in each transformation, our ultimate return being perhaps ten per cent of the energy expended; when we add to this the complication and expense of a steam-plant, — it would seem that, even if our means of direct conversion is not so economical as the dynamo, yet if it have any reasonable efficiency, and is simple of construction, it would supplant the older method.

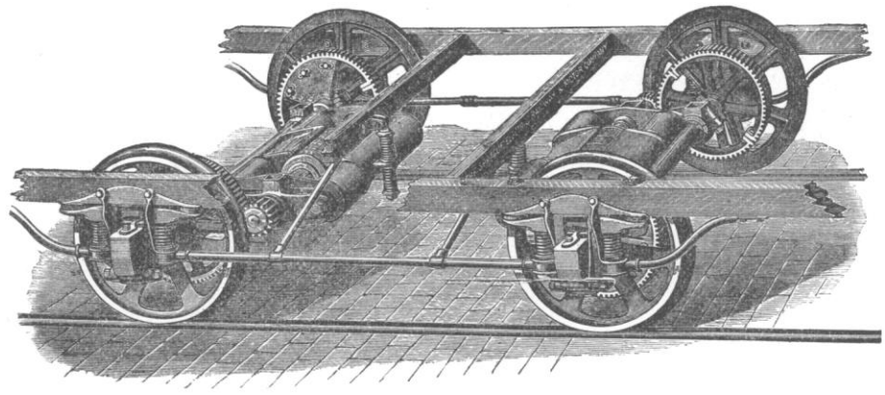
In August of 1887 Mr. Edison read before the American Association for the Advancement of Science a paper on pyromagnetic generators. Briefly the principle on which his machine was built is this. If a piece of iron wrapped with wire be put between the poles of a magnet, a number of lines of force will pass through it, and therefore through the coils of the wire, depending directly on the strength of the magnet and on the magnetic permeability of the iron. Now, it is well known that the permeability of iron becomes very nearly zero when it is raised to a bright red heat: so, if we heat the iron, the lines of force through it will decrease, and this decrease will cause an electro-motive force in the coil of wire. When the iron cools, there will be an increase of lines of force, causing an electro-motive force in the opposite direction. Mr. Edison's machine, built on this principle, consists of eight horse-shoe magnets arranged in a circle, the poles facing inward; and between the poles of each is a roll of thin laminated iron covered with asbestos and wrapped with wire: we will call these the armatures. This is placed over a furnace, and beneath it revolves a half-circle of fire-clay, which shields half of the armatures from the heat. If this shield be turned continuously, half of the armatures are being heated while the other half are being cooled; and the electro-motive forces in the two halves, which would be in opposite directions, are added by a commutating arrangement on the shaft of the shield. A blast of cold air assists the cooling of the armatures.

In his paper, Mr. Edison gave no data as to the performance of the machine, except the statement that a generator to feed thirty incandescent lamps would weigh two or three tons.

Nothing has been heard lately of this generator: it will naturally take time to perfect it and make it practical.

Within the last month, however, attention has been called to a machine using the same general principle as that of Mr. Edison, but differing greatly in detail, — an invention of M. Menges of the Hague.

One form consists of a Gramme ring within which is a stationary electro-magnet. The two are horizontal, and are separated by a considerable air-space: this space is filled by a zigzag ribbon of iron extending around the inner circumference of the ring, with which it revolves. Now, if this ribbon of iron be cold, most of the lines of force will pass through it from one pole to the other of the magnet: few will go through the armature. If, however, the ribbon be heated at points at right angles to the poles, the magnetic resistance will be increased, and most of the lines of force will pass through the armature: there will be no motion, since every thing is perfectly symmetrical. If, now, the heat be applied to the ends of the same diameter at points forty-five degrees from the pole, the symmetry disappears, and there will be a rotation. Now, the Gramme ring rotating in a field of force will generate currents as in an ordinary dynamo-electric machine. In reality, then, we have a motor-dynamo arrangement, the former transforming the energy of heat into motion, the latter transforming the energy of motion into electrical energy.



THE SPRAGUE STREET-CAR ELECTRIC MOTOR.

Both the 'pyromagnetic generators' of Mr. Edison and M. Menges are an advance on previous machines of this type. It is difficult to see, however, how, in their present form, either can produce any very considerable quantity of electrical energy, with any reasonable size of apparatus. The publication of reliable figures on the performance of these machines would be of great interest.

Sprague Electric Railway in Richmond. — There was opened for traffic on Feb. 2 an electric street-railroad that from the extent of the plant, the difficulties overcome, and the perfection of equipment, marks a decided advance in electric traction. The Union Passenger Railway system in Richmond extends from the eastern to the western part of the town, having a total length of track of eleven miles. The road has many curves of short radius. There are grades that reach ten per cent, while there are combinations of curves and grades even more difficult than the steepest of the grades. In one case there is a thirty-foot curve on an ascent of seven per cent. In addition to this, but a small part of the length is through paved streets, and in wet weather the mud is so bad that in some places it completely covers the rails. The road is equipped with forty large sixteen-foot cars. Beneath each car are two 7½-horse power motors, one geared to each pair of wheels. The current is taken from an overhead wire by a wheel or trolley of sheet brass fixed on the end of a rod which holds it up underneath of and in contact with the wire. This rod is fixed on trunnions, and is fitted with springs that give a gentle pressure at the contact. The motors, nominally 7½-horse power each, are capable of developing over ten-horse power when necessary. They

are beneath the car, out of sight, and are geared by a system of spur-gears to the axle of the car-wheels. Each motor is swung in a cradle one end of which pivots on the car-axle, — the axle passing through bearings in the cradle, — while the other end is fastened to the car-frames by heavy spiral springs above and below. These springs are for the purpose of avoiding any sudden strains. Between the gear on the motor shaft and that on the car-axle is an intermediate gearing which is fitted on its axle with rubber cushions to give additional relief from shocks. The whole gear system works easily, and makes very little noise. The switches for controlling the current are on both platforms, the car running in either direction. The coils of the field-magnets of the motors are divided into a number of sections, and the switch makes different arrangements of these coils, putting them all in series (when the current is least) or in parallel (when the current is greatest), or using different combinations for intermediate powers. The cars are under perfect control: they start easily, and can be backed instantly in case of emergency. Brakes are used both for the wheels and on the track, the ordinary wheel-brake not being sufficient for some of the steep grades that occur. Power is supplied from a central station in about the middle of the line. There are six dynamos, giving 500 volts and 80 ampères each. The line was opened for traffic with ten cars running. They were crowded with passengers during the day; and the heavy travel, together with the inexperience of the drivers, was a severe test for the system. There were a few small troubles, but these were soon rectified; and, on the whole, the day's work seemed to prove the system a success.

BOOK-REVIEWS.

Political Economy. By FRANCIS A. WALKER. 2d ed. New York, Holt. 8°.

IT would be superfluous to commend to American readers any economic writing by President Walker. His clear style, vigorous thought, and terse expression have long since placed him in the front rank of economic thinkers, whether American or European. His wide experience and his philosophic insight raise him far above those scribblers of ephemeral pamphlets who are crying now for socialism, now for co-operation, now for *laissez faire*, and all under the name of 'political economy.' President Walker sees very clearly that economics, if it is a science at all, is only to be studied in the ever-varying phenomena of human nature, and he would be the last to attempt to regulate or produce either character or productivity by statute.

The present volume is the best adapted to the present needs of students in the United States, of any that have come from the press. Not only are the general topics of political economy treated fully and with ample illustration, but a concluding part (and a generous one) is given to the discussion of present problems under the head of 'Some Applications of Economic Principles.' We do not follow President Walker in his virtual indorsement of the Ricardian theory of rent, or of Malthusianism; for, despite what he says, both doctrines appear to us to be mere approximations, and not certainties. It is the assumption of their certainty, and the basing of elaborate deductions upon them, which have made so many of the theoretical conclusions of political economy so absurdly at variance with facts. On the wages question President Walker is particularly strong and clear, and his conclusions incontestable. It is interesting to see a professed economist write of the system of protection as the author does. His fellow-economists are given to abuse and the hurling of epithets as soon as the subject is mentioned; but President Walker, in a fairer spirit, writes, "If the protectionist can show that restraints imposed by law upon the industrial action of his countrymen, or the men of any country he chooses to take for the purposes of the debate, have the effect not, indeed, to generate productive force, but to direct the productive force generated by human wants, setting in motion labor with a better actual result than under the rule of freedom, he will make his case. But this is to be proved, not taken for granted; and it is only to be proved by sound and serious argument, not by strenuous exertion and senseless clamor" (pp. 508, 509). This is a position which all rational men can accept; and it is infinitely removed from the line of argument, or rather of invective, pursued by Professors Sumner and Perry. President Walker's argument in Paragraph 615, we do not, however, quite understand; for it seems to imply that the advocates of protection insist on that as a universal fiscal policy with a view to making industrial entities correspond to political ones. As we read their arguments, on the other hand, no such claim is made. It is only asserted that protection is best for the United States at this time. At all events, a free-trade argument on the basis indicated by the writer would be both valuable and interesting.

We cannot refrain from expressing the wish that this book may find its way into more of our colleges, for it is worthy of them.

Nuttall's Standard Dictionary of the English Language. New edition, revised by Rev. James Wood. New York, Warne & Co. 8°. $1.50.

GREAT improvements have been made of late years in concise and handy dictionaries. Those formerly in use contained but a small proportion of the words in the language, and many of the definitions were nothing but synonymous terms; so that, for every purpose of real scholarship, reference had to be made to a large dictionary. But now we have several dictionaries of convenient size and low price, which really serve their intended purpose, and one of the best of these is that now before us. We have not examined the work in detail; but such examination as we have been able to give it shows it to be worthy of the popularity it has already attained. The definitions — always the main point in a dictionary — are up to the level of those in other English dictionaries, and the various meanings of the same word are distinguished with much fulness and accuracy. Illustrative examples from authors are not given, as the smallness of the book forbids it; but there are some pictorial illustrations, though not so many as in some other dictionaries of a similar character. The orthography is that usually employed in England, including the *u* in such words as 'honour.' The pronunciation is indicated by respelling, with only a slight use of diacritical marks, — a method which, for young people and for many older ones, has certain advantages. The present revised edition contains many new words of science and literature, and indicates in a brief way the derivation of the more important words when this is not obvious. At the end of the volume are the usual vocabularies of proper names, and a brief list of proverbs and quotations from foreign languages, with their meaning in English. The type employed in the book is necessarily small, though not so small as in some other concise dictionaries, and it is new and clear. The book is a medium octavo of eight hundred pages, and will be useful to all who wish for a dictionary of this character.

Hand-Book of Volapük. By CHARLES E. SPRAGUE. New York, The Office Co. 12°. $2.

Volapük. By KLAS AUGUST LINDERFELT. Milwaukee, Casper. 16°. 50 cents.

THE bibliography of Volapük now comprises about a hundred books, but, probably for reasons well presented by Professor Bell in *Science* of Jan. 27, very few of these works are in English. The above are two out of the first half-dozen books on the subject in the English language, though many periodicals in this country have given considerable space, especially during the past few months, to Volapükian literature. Mr. Sprague, who appears to be at the head of the movement in this country, gives, in the introduction to his hand-book, a brief history of the new language and of its rapid progress in Europe. He states that it was invented and first published in 1879 by Johann Martin Schleyer, a German priest, whose object was, "first, to produce a language capable of expressing thought with the greatest clearness and accuracy; second, to make its acquisition as easy as possible to the greatest number." He sought to accomplish these ends "by observing the processes of the many languages with which he was acquainted; following them as models wherever they were clear, accurate, and simple, but avoiding their faults, obscurities, and difficulties." The result of his labors is a language whose "rules have the advantage of being absolute, and unburdened with exceptions," as Professor Bell puts it. A clear and attractive exposition of the new language, in small compass, is given by Mr. Sprague, who modestly claims that the most obvious application of it, in the immediate future at least, is for international correspondence, especially commercial correspond-